Tsunami (soo-NAH-mee)

Tsunamis (Japanese translation "harbor wave") are waves with a great distance between crests, and are caused by any widespread, sudden movement of large volumes of water. The tsunami grows tall as the ocean shallows, such as in a harbor. In ancient Japan, the people often witnessed the wave rise directly out of the harbor and coined the term tsunami. Tsunamis are most prevalent in the Pacific Ocean, but are known to occur in all ocean basins.

Ten Deadliest Tsunamis

<u>Rank</u>	<u>Deaths</u>	<u>Date</u>	Tsunami Location
1)	226,898	2004	Indian Ocean
2)	50,000	1755	Lisbon, Portugal
3)	36,000	1883	Krakatoa Is., Ind.
4)	31,000	1498	S. Honshu, Japan
5)	27,122	1896	Sanriku, Japan
6)	25,000	1868	Arica, Chile
7)	15,845	2011	Tohoku, Japan
8)	13,486	1771	Ryukyu Trench
9)	8,000	1586	S. Honshu, Japan
10)	5,443	1792	Mt. Unzen, Japan

For more information on historical tsunamis, please see the NOAA/National Geophysical Data Center website at http://www.ngdc.noaa.gov/hazard/tsu.shtml.

Tsunami Generation occurs

when the sea level is suddenly moved vertically over a wide area. This results in the generation of long wavelength waves, or what we call tsunamis. According to the NOAA National Geophysical Data Center, approximately 80% of all tsunamis are generated by earthquakes. Other sources include volcanoes, landslides, and meteor impacts.

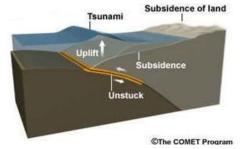
Most earthquake-generated tsunamis are triggered near tectonic plate boundaries where the plates move together. This type of boundary is known as a subduction zone.

Strong shaking due to earthquakes or volcanic eruptions can trigger landslides which slide into or under the ocean. These landslides, if large enough, can then trigger deadly tsunamis.

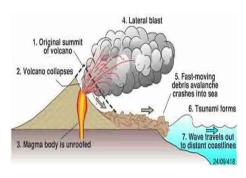
For additional interactive information, please visit the tsunami training courses at https://www.meted.ucar.edu/training_detail.php and

Crustal Uplift

near subduction zone

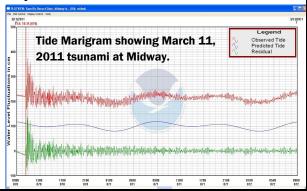


Volcano



Tsunami Inundation occurs when a tsunami covers normally dry land. Inundations are the most dangerous manifestations of a tsunami, and are one of the most costly and deadly coastal hazards that can impact coastal communities in the U.S. A picture of Japan's March 11, 2011 tsunami inundation and its tide gauge signal (marigram) at Midway Island are shown below.





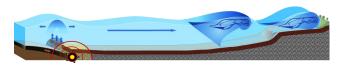
Tsunami Characteristics

A tsunami is a series of traveling ocean waves which are several hundred kilometers in length, five to 60 minutes between crests, and can endanger coastlines for +25 hours. Often generated by large earthquakes in oceanic coastal regions, the rupture displaces the entire water column extending from the sea floor to the surface.

As the tsunami crosses the deep ocean, its length from crest to crest may be a hundred miles or more; height from trough to crest of only a few feet or less. It is not normally noticed aboard ships in deep water, nor seen from the air. Tsunami speed is proportional to water depth; in deep water it exceeds 500 mph.

When a tsunami enters shallow water, its velocity diminishes as wave height increases. It is in these shallow waters that tsunamis become a threat to life and property, for they impact like a fast rising flood striking with devastating force. Rarely, they build up into a vertical wall of water or bore. Associated currents reaching up to 30 knots (26 mph) are one of the most destructive aspects.

Tsunami scientists are making great strides towards wave height prediction. New mathematical models in conjunction with sea level data allow Warning Centers to estimate approximate wave heights prior to arrival, thus assisting coastal communities to prepare.



Tsunami Warning System

U.S. tsunami warnings are issued by NOAA's two Tsunami Warning Centers: the West Coast and Alaska Tsunami Warning Center (WC/ATWC) located in Palmer, Alaska and the Pacific Tsunami Warning Center (PTWC) located in Ewa Beach, Hawaii. WC/ATWC issues information to all U.S. states except Hawaii, U.S. territories in the Caribbean, and Canada. PTWC is responsible for Hawaii, U.S. territories in the Pacific, and international recipients in the Pacific and Indian Oceans, and the Caribbean Sea.

The Warning Centers monitor a world-wide network of seismic and sea-level stations, providing the basis for which tsunami warnings, advisories, watches, and information statements are issued.

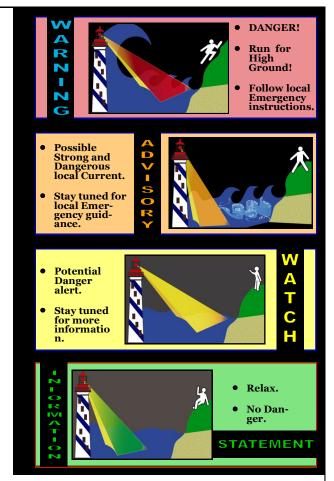
Four types of tsunami messages are issued by the tsunami warning centers and are explained in the next panel.

Messages are updated frequently as water level data becomes available. These data could confirm a tsunami and give scientists critical information for wave evaluation.

A WARNING can be cancelled or downgraded to an advisory, which is a lower level of danger. The 'All Clear' is always issued by local Emergency Managers.

You can receive messages via E-mail, RSS, Internet, radio, NOAA Weather radio, marine radio and TV. TsunamiReady communities are often equipped with sirens and other notification techniques.

Learn about your community's tsunami policies and evacuation routes by contacting your local emergency management office.



WARNINGs, initially based solely on seismic data, are issued as quickly as possible indicating that a significant inundation may occur.

ADVISORYs indicate potential beach and harbor danger due to strong currents; significant widespread inundation is not expected.

WATCHs indicate that a potentially dangerous distant event has occurred and to be alert for more information.

INFORMATION STATEMENTs are normally used to verify that there is no tsunami danger, but can also be used in the early stages of a distant event when little is known.

Tsunami Safety Rules

- 1. Always be prepared, a tsunami may occur anytime.
 - a. Prepare a family emergency plan.
 - b. Prepare a safety backpack.
 - Identify the danger zones, safe areas, and the assembly locations.
 - d. Identify evacuation routes.
- 2. Pay attention to any of these warning signals.
 - Very strong earthquake (it is difficult to walk, there are falling objects, damage to structure)
 - b. Long duration earthquake (about 20 seconds or more)
 - c. Official message by sirens, commercial radio, television, NOAA radio
 - d. Sudden sea level change
 - e. Loud noise coming from the sea
- 3. In case of an earthquake protect yourself.
 - a. Drop
 - b. Cover
 - c. Hold on
- Move away from hazard areas (in preference order depending on your location)
 - a. Run to higher ground and/or away from the coast to a tsunami shelter or assembly area.
 - b. Go to a third floor or higher.
 - c. Climb a tree.
 - If you are on a boat, move to deeper water (at least 300 feet).
 - If the wave is over taking you, grab something that floats.
- Stay in the safe area until Authorities indicate the danger has passed, this may take many hours.



Tsunami



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